

***Puccinia malvacearum* and *P. xanthii* newly recorded from Pakistan**

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ABSTRACT—During a survey of plant pathogenic fungi of Parachinar, Khyber Pakhtunkhwa, Pakistan, two plant species, *Malva neglecta* (Malvaceae) and *Xanthium strumarium* (Asteraceae), were found to be infected with rust fungi. After careful morphological observations, these rusts were identified as *Puccinia malvacearum* and *P. xanthii*, which are new records for Pakistan.

KEY WORDS—Cocklebur rust, Koh-e-Safaid, Kurram Agency, *Pucciniales*

Introduction

Parachinar is the capital city of Kurram District in Khyber Pakhtunkhwa, Pakistan. It is located at 33.9011°N 70.0860°E, at an altitude of 1726 m above sea level. Parachinar is bounded by high mountains on all sides and the major range is Koh-e-Safaid, which makes a natural boundary with Tora Bora mountain of Afghanistan and is covered with snow for most of the year. The name “Parachinar” comes from ‘Para’, one of the famous ancient tribes known as the ‘Parikhel’ and ‘Chinar’, the maple or pine trees which are found in abundance in the region. This area has some patches of oak and pine vegetation. Plant diversity, life style, and dispersion of plants are linked with the altitude and precipitation (Badshah & al. 2016). Due to its geographical location, little work has been done on floral diversity of this area, particularly fungal flora as we could not find any literature related to this aspect of natural vegetation. In order

to explore this floristically diverse but neglected area, visits were conducted in 2018 & 2021. During this exploration, two plant species, *Malva neglecta* and *Xanthium strumarium*, were found to be infected by rust fungi. After careful morphological analysis, these rusts were identified as *Puccinia malvacearum* and *P. xanthii*, which are presented here as new records for Pakistan. Previously, no rust fungus had been reported from this area.

Materials & methods

Plants infected with rust fungi were collected from Kurram District, Parachinar, Khyber Pakhtunkhwa province, Pakistan. Healthy plants with fruits and inflorescences were also collected for identification. Infected plants were photographed in the field and under the stereomicroscope. Host plants were identified by comparing with plants in the herbarium of Institute of Botany, University of the Punjab, Lahore (LAH).

Scratch mounts and free hand sections of infected portions were mounted in lactophenol. Partial permanent slides were made by cementing glass cover slips with nail lacquer; slides were examined under a biological microscope (LABOMED, Labo America, Inc. USA). Line drawings of different spore stages were made using a Camera Lucida (Ernst Leitz, Wetzlar, Germany). Dimensions of spores were taken using Scope Image 9.0(5X) with 40× objective. Forty spores were measured for each species. SEM micrographs were taken in the Centralized Resource Laboratory (CLR), Department of Physics, University of Peshawar, Pakistan. The specimens were deposited at the herbarium of the Institute of Botany, University of the Punjab, Lahore, Pakistan (LAH).

Taxonomy

Puccinia malvacearum Bertero ex Mont., Fl. Chil. 8: 43 (1852)

FIG. 1

TELIA amphigenous, mostly hypophyllous, light brown to chestnut-brown, pustules scattered on surface of leaves and petioles. TELIOSPORES 2-celled, $14\text{--}29 \times 22\text{--}40\text{--}52\text{ }\mu\text{m}$; wall $2\text{--}4\text{ }\mu\text{m}$ thick at sides, light brown to hyaline or chestnut-brown, smooth, apex hyaline to light brown, $5\text{--}12\text{ }\mu\text{m}$ thick; pedicel long, hyaline, $5\text{--}15 \times 48\text{--}163\text{ }\mu\text{m}$.

MATERIAL EXAMINED: PAKISTAN, KHYBER PAKHTUNKHWA, Kurram District, Parachinar, 1726 m asl, on *Malva neglecta* Wallr. (*Malvaceae*), stage III, July 2018, Abdul Nasir Khalid NRPU#32 (LAH0718); Parachinar, Zeran, 1874 m asl, on *Malva neglecta*, stage III, 5 August 2021, Mohammad Aijaz Ahmad & Abdul Nasir Khalid NRPU#101 (LAH37120).

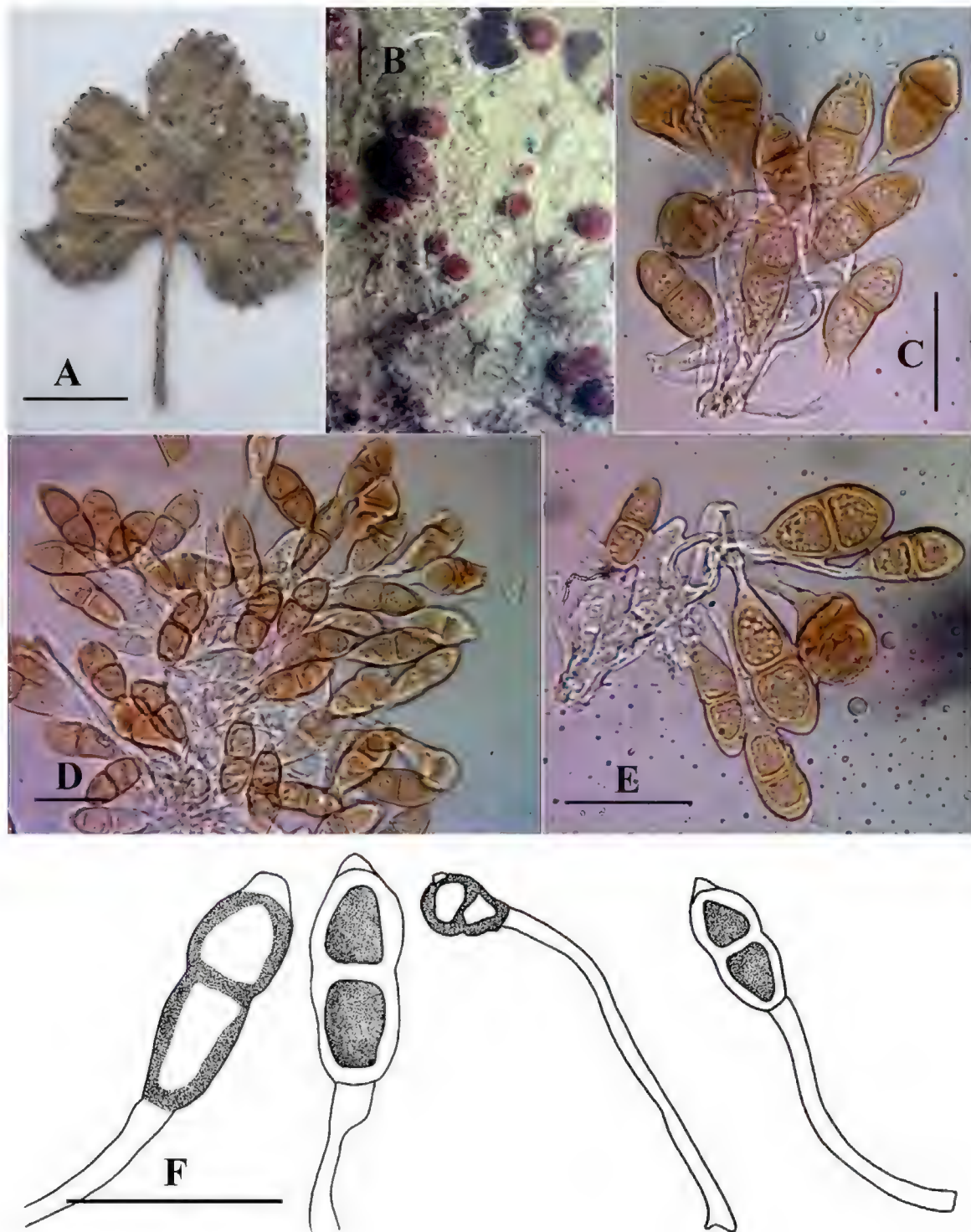


FIG. 1: *Puccinia malvacearum* (LAH0718). A. Infected leaf of *Malva neglecta*; B. Infection under stereomicroscope; C–F. Teliospores. Scale bars: A = 0.5 cm; B = 1 mm; C–F = 40 μm. (Drawing by Maria Riaz).

COMMENTS—The size, color, and morphology of the teliospores fit the description of *Puccinia malvacearum* (Demers & al. 2015). *Puccinia malvacearum* was collected on *Malva neglecta* and represents a new record for Pakistan; and no other rust fungus has been reported on *Malva* spp. from Pakistan. *P. malvacearum* is cosmopolitan in distribution and has been reported

to infect several genera of the mallow family (*Malvaceae*) worldwide (Ahmad & al. 1997; Farr & Rossman 2022).

Puccinia xanthii Schwein., Schr. Naturf. Ges. Leipzig 1: 73 (1822)

FIG. 2

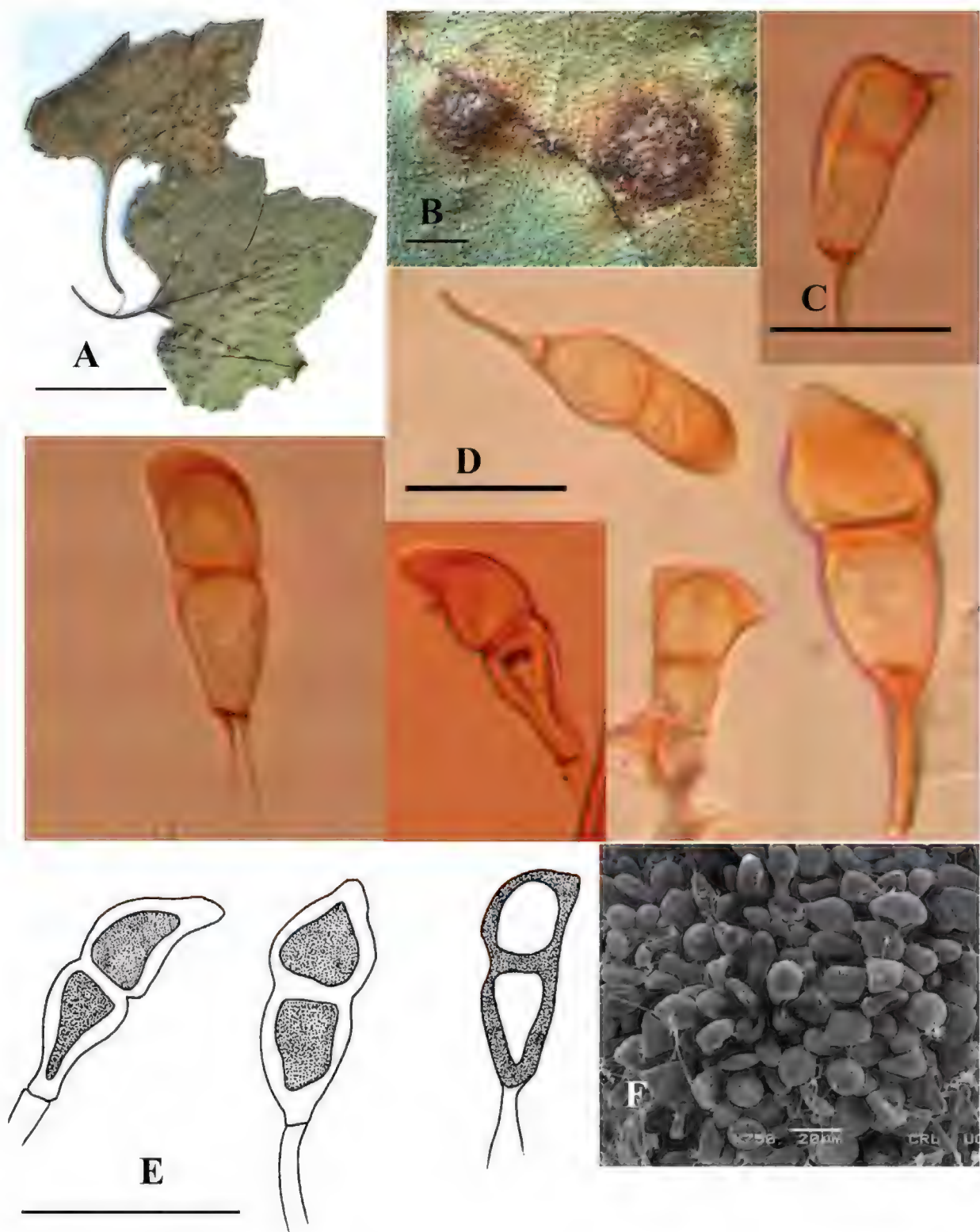


FIG. 2: *Puccinia xanthii* (LAH2307). A. Infected leaves of *Xanthium strumarium*; B. Infection under stereomicroscope; C–E. Teliospores; F. Teliospores under SEM. Scale bars: A = 5 cm; B = 1 mm; C–E = 40 μ m. (Drawing by Maria Riaz).

TELIA amphigenous, mostly hypophyllous, dark brown in circular patches on leaves. TELIOSPORES 2-celled, clavate to ellipsoid, light brown to cinnamon-brown, $17\text{--}23 \times 42\text{--}58 \mu\text{m}$, wall $0.2\text{--}1.5 \mu\text{m}$ thick at sides; apex mostly conical, rarely rounded or truncate, light brown to cinnamon-brown, $5\text{--}10 \mu\text{m}$ thick; pedicel hyaline to light brown, $2\text{--}11 \times 16\text{--}40 \mu\text{m}$, mostly broken.

MATERIAL EXAMINED: **PAKISTAN, KHYBER PAKHTUNKHWA, Kurram District**, Parachinar, 1726 m asl, on *Xanthium strumarium* L. (*Asteraceae*), stage III, July 2018, Abdul Nasir Khalid NRPU#41 (LAH2307); Parachinar, Agra Valley, 1829 m asl, on *Xanthium strumarium*, stage III, 7 August 2021, Mohammad Aijaz Ahmad & Abdul Nasir Khalid NRPU#102 (LAH37121).

COMMENTS—*Puccinia xanthii*, commonly known as cocklebur rust, is circumglobal on species of *Xanthium* L. and *Ambrosia* L. The size, color, and morphology of the teliospores fit the description of *Puccinia xanthii* (Dávid & al. 2003). No rust fungus has been reported on *Xanthium* spp. from Pakistan, and *P. xanthii* is a new record for the country; it has been reported on various species of *Xanthium* from different countries worldwide (Farr & Rossman 2022).

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